Minásbate Equivalents of Mathematical Concepts: Their Socio-Cultural Undertones

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ABSTRACT

This paper presents the collection and analysis of Minásbate equivalents of some concepts used in the study of arithmetic, counting, and geometry as provided by the elderly residents of the province of Masbate. The glossary of mathematical terms derived from interviews would serve as an authoritative reference for mother tongue teachers in the local primary schools. Some implications on the locality's historical and socio-cultural landscapes were deduced from the scrutiny of terminologies, such as the assimilation of foreign and neighbouring languages and the predominance of representational thinking among the natives.

Keywords: *mathematics, language, Minásbate, linguistic determinism*

INTRODUCTION

During the prehistoric times, Filipinos were already great sailors and ship builders. They already travelled to their Asian neighbours and other faraway places. They could have not done it without the knowledge of mathematics (Tirol, 2010; Zaide, 1999).

At the same period, Filipinos could count up to 100,000,000 and were capable of performing addition, subtraction, multiplication, and division. They had their own native terms for counting numbers and units for weights and measures. They used mathematics in their daily lives as warriors, hunters, fishermen, miners, lumbermen, shipbuilders, cooks, gardeners, sewers, and housekeepers (Zaide, 1999; Reyes, 1992).

When the Spaniards came, many of the rich mathematical terms became extinct. Many native terms were lost due to the absence of durable writing mediums and the dominating oral tradition in pre-colonial Philippines. Furthermore, the colonizers replaced the local terms with their own for ease of use (Tirol, 2010). Fortunately, unlike the Spanish colonies in Latin America, some of the native terms were preserved incidentally when the Spanish friars studied the native languages and used them in missionary activities (Zaide, 1999).

Minásbate, the language spoken by Masbateño people,is one of the diverse tongues of the Philippine archipelago. It is a complex language used by approximately 350,000 people whose native islands (Masbate, Ticao, and Burias) are surrounded by Bicol, Southern Tagalog, Romblon, Panay, Cebu, and Samar-Leyte where migrants of different language groups have close interaction with the natives.Thus,a remarkable feature of Minásbate can be noted, which is the presence of competing grammatical and lexical subsystems in the language (Wolfenden, 2001). It is mainly Bisaya, but the Bicolanos geographically alter the Visayan genre to some extent. While it is in part Tagalog, others could claim that some words were derived from Ilonggo and Waray-waray (MNCHS, undated).

Only a handful studies and literature on Minásbate can be found, unlike its neighbouring languages. The most recent study of Minasbate language was done by Wolfenden (2001) and Rosero(2009). No attempt thus far has been made by local researchers to further study the language and its implications on the culture of Masbateño people. The purpose of this research is to collect and analyse the terms or concepts used in mathematics and the existence of their Minásbate equivalents as determined and understood by elderly native residents of Masbate.

Significance of the Study

The collection and analysis of the local terms used to describe or denote certain mathematical concepts will significantly contribute to the understanding andpreservation ofMasbateño language and culture, and the promotion of self-esteem and identity of the natives. Furthermore, the outputs of this study will be of benefit to teachers of mother tongue in

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the primary grades. A collection of mathematical terms and their Minásbate equivalents will help the mother tongue teachers, especially those who are non-speakers of the language, explain mathematical thoughts to their native pupils through more accurately familiar medium.

OBJECTIVES OF THE STUDY

This study aimed to determine the local equivalents being used by Masbateño people in denoting certain concepts of counting, arithmetic, and geometry; What are the historical and socio-cultural implications of the regularity and shortage of Minásbate equivalents for mathematical concepts?

METHODS

This research employed both qualitative and quantitative approaches. After the interviews, the number of respondents who gave the Minásbate equivalent for a certain English mathematical term or concept was used to determine the usage regularity of the equivalent. *Regularity* is defined as the frequency of usage or the commonness of a term. The derivation of the equivalent term was also analysed to determine the original language from which it was borrowed or to which it is similar. Furthermore, the number of respondents who did not give an equivalent (for a geometric figure, in particular) was also used to infer the lack of a local term—which this study called *shortage*—to represent a certain abstract mathematical concept. Each equivalent term was classified as either representing concrete or abstract concepts.

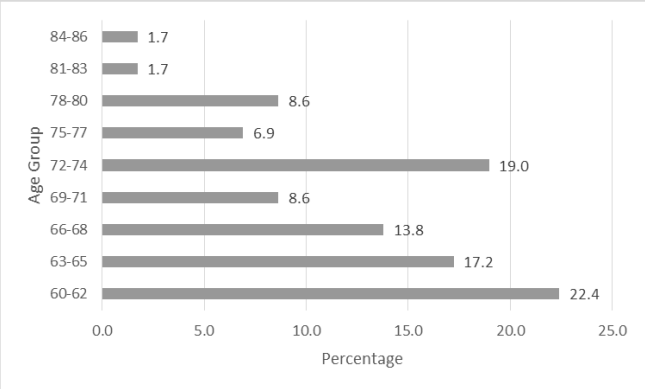

Figure 1. Age distribution of the respondents.

The participants of the study were selected using a convenient sampling procedure. There were fifty-eight (58) elderly natives involved composed of 24 males and 34 females. About forty percent of the respondents availed of elementary, 27.6% proceeded to high school, and 15.5% reached tertiary education, while 8.6% were unschooled and 8.6% had unknown educational backgrounds. They were elderly citizens whose ages range from 60 to 85 years and whose residences are located in some municipalities of the three islands of the province—Masbate, Ticao, and Burias.

This study, however, did not use sampling procedure which equally distributes respondents to each municipality. The age and locality distributions of the respondents are shown in Figures 1 and 2, respectively.

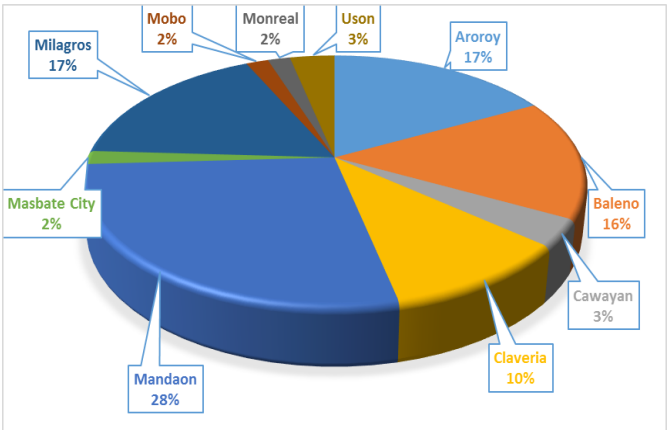

Figure 2. Distribution of the respondents by locality.

The instrument was composed of questionnaires containing some English mathematical terms with Filipino equivalents and some geometric figures. The respondents were tasked to supply their known Minásbate equivalent terms for concepts involved in counting and ordering numbers, fundamental operations, comparing quantities, plane and solid geometric figures.

RESULTS AND DISCUSSIONS

Three variables were used in the scrutiny of responses: the equivalent's lexical derivation and similarity, usage regularity and shortage, and type of concept/equivalent exemplified by the term. The theoretical framework that guides the analyses of these variables is *linguistic determinism*, a strong feature of Sapir-Whorf hypothesis "because it holds that the language we speak determines how we perceive and think about the world" (Fromkin, V., Rodman, R., & Hyams, N., 2010: 34-35). Furthermore, Wierzbicka (1997) argued that words with special, culture-specific meanings obviously reveal and convey not only ways of living characteristic of a certain society but also ways of thinking.

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Table 1.The Minásbate equivalents of some arithmetic concepts and their lexical derivation/similarity with other languages/dialects

Mathematical term in English	Minásbate equivalent*	Root word	Meaning	Lexical Derivation/ Similarity
1. Add (+)	*Dugangan*	*Dugang*	Add	Ceb.
	Dagdagan	*Dagdag*	Add	Tag.
	Magplas	*Plus*	Sign of addition	Eng.
2. Subtract (-)	*Ibanan*	*Iban*	Deduct	Ceb.
	Bawasan	*Bawas*	Deduct	Tag.
	Halian	*Hali*	Take away	Bic.
	Tangkasan	*Tangkas*	Remove	Mas.
	Minus	Minus	Sign of subtraction	Eng.
3. Multiply (x)	*Padamuon*	*Damu*	Increase in number	Mas.
	Piluon	*Pilo*	Fold	Ceb.
	Doblehon	*Doble*	Increase twice	Sp.
	Tayms	Times	Sign of multiplication	Eng.
	Multiplikar	*Multiplicar*	Multiply	Sp.
4. Divide (/)	*Tungaon*	*Tunga*	Half	Mas.
	(Bahin-)Bahinon	*Bahin*	Share	Ceb.
	Partehon	*Parte*	Share	Sp.
	Bulagon	*Bulag*	Separate	Mas.
	Idibider	Divide		Eng.
5. Sum	*Tanan*	*Tanan*	All	War.
	Kabilugan	*Bilog*	Whole	Tag.
	(Suma-)total	*Suma+total*	Sum	Sp.
	Entiro	*Entiro*	Whole	Sp.
	Bale	*Bale*	Equals	Mas.
	Buo	*Buo*	Whole	Tag.
6. Difference	*(Na)bilin*	*Bilin*	Remaining	Mas.
	Diperensya	Difference		Eng.
7. Product	*Tanan-tanan*	*Tanan*	Overall	War.
	Produkto	Product		Eng.
8. Quotient	*Bahinan, barahin*	*Bahin*	Share	Mas.
	Tungaan, turunga, tinunga	*Tunga*	Share	Mas.
9. Percent (%)	*Porsyento, porsyentahe*	*Porciento*	Percent	Sp.
	Tubo	*Tubo*	Interest	Tag.
	Ganansya	*Gana*	Profit/win	Mas.
10. Fraction	*Tunga, katunga*	*Tunga*	Half	Mas.
	Kaparte	*Parte*	Share	Sp.
	Partida	*Parte*	Share	Sp.

** Equivalents are arranged from the highest to the lowest percentage of regularity*

Abbreviations for language derivation: Sp. *Spanish*, Eng. *English*, Ceb. *Cebuano*, Tag. *Tagalog*, Mas. *Minásbate*, War. *Waray-waray*, Bic. *Bicolano*, Hil. *Hiligaynon*

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Mathematical Concepts and Their Minásbate Equivalents

A. Fundamental mathematical operations

Terms used in teaching-learning arithmetic were carefully chosen. There were ten (10) terms included in the questionnaire, which denote basic mathematical operations such as the verbs *add*, *subtract*, *multiply*, and *divide*, including their respective results as *sum, difference*, *product*, and *quotient*, including the ratio terms *fraction* and *percent*. The respondents gave the equivalents of the verbs with added prefixes and suffixes. So the root word was determined for purposes of easily identifying the original or related language/dialect. Table 1 shows the arithmetic concepts, their equivalents and lexical derivation/similarity.

One can note in the table that sets of different concepts have similar equivalents. The term *sum* has an equivalent *tanan* which means "all", and *product* has *tanan-tanan* or "all-in-all"; thus, the two concepts are believed to be the same concept on account of the similarity of the equivalents. The natives consider multiplication as repeated addition. Furthermore, the terms *quotient* and *fraction* have the same equivalent term *tunga* which means "half". The natives' concept of division and fraction is dividing a quantity into two equal parts.

The knowledge of percentage was weak as it was only conceived to be an increment or interest rate. This concept of *percent* emanates from situations involving financial matters, like loans and business, and is unexploited in other cultural aspects of the natives.

Some equivalent terms were akin to other local and foreign terms. For example, the concept of subtraction has four equivalents with different derivations: the term *iban* is Cebuano, *bawas* is Tagalog, *hale* is Bicolano, and *minus* is English. Likewise, equivalents of Spanish origin were observed such as *multiplikar, porsyento, parte, doble*, and *suma-total*. This suggests the influence of various language groups in Minásbate language.

B. Comparing quantities

In comparing two quantities, there are three relations: one quantity is greater (>), less (<), or equal (=) to the other. For the natives, quantity pertains to size, measurement, number, and amount. The equivalent *mas dyutay*(or variants *dyut* or *dyuting*) for "less than" describes the minuteness in size compared to another size. In contrast, *mas daku/damu*represents the relatively greater size or number. *Dyutay* means small size and number, while *daku* and *damu* denotes large size and number/amount, respectively. In the field of measurement it can be modified into *mas halip-ot* (shorter) to denote "less than" and into *mas halaba*(longer) to denote "greater than". Furthermore, in the equality of two quantities, there are 6 equivalents. Some of which denote symmetry, like *kaparehas* and *kapara* which mean *similar* and *seemingly alike*, respectively.Lastly, the term *bale* which is commonly used as an outcome summation is considered as a concept of equality. The equivalents *katumpar* (*katumbas* in Tag.) and *kabalyo* imply concepts of equilibrium and exchange/return.

Table 2. The Minásbate equivalents of mathematical concepts in comparing two quantities and their lexical derivations/similarity

English mathematical term	Minásbate equivalent	Root word	Lexical Derivation/ Similarity
1. Less than (<)	*Mas diyut(ay)*	*Mas +dyutay*	Sp. + Mas.
	Mas diyuting	*Mas + dyuting*	Sp. + Mas.
	Mas gamay	*Mas + gamay*	Sp. + Ceb.
2. Greater than (>)	*Mas daku*	*Mas + daku*	Sp. + Ceb.
	Mas damu	*Mas + damu*	Sp. + Mas.
3. Equal (=)	*Katumpar*	*Tumpar*	Tag. (*Tumbas*)
	Kaparehas, pareho	*Parejo*	Sp.
	Kapara	*Para(ng)*	Tag.
	Kabalyo	*Baylo*	Hil.
	Bale	*Bale*	Mas.

It can be noted from Tables 1 and 2 that each single term has multiple equivalents. Furthermore, the equivalents have various lexical derivations or similarity with other foreign and neighbouring languages. This phenomenon is most likely the collective effect of influx of settlers from other language groups, Spanish colonization, and dominance of English as medium of instruction in schools.

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Table 3. Minásbate counting and ordering

Counting in English	Minásbate equivalent	Ordering in English	Minásbate equivalent
Zero (0)	Wara Sero Buklo Botlog	First	(Pan-, pang-, ika-) + usad/usad, una, primero, primera
		Second	(Pan-, pang-, ika-) + duwa/duha, segunda
		Third	(Pan-, pang-, ika-) + tulo, tarsera
		Fourth	(Pan-, pang-, ika-) + upat
One (1)	Usad/isad, uno	Fifth	(Pan-, pang-, ika-) + lima
Two (2)	Duwa/duha, dos	Sixth	(Pan-, pang-, ika-) + unom
Three (3)	Tulo/tatlo, tres	Seventh	(Pam-, pang-, ika-) + pito
Four (4)	Upat, kwatro	Eighth	(Pang-, ika-) + walo
Five (5)	Lima, singko	Ninth	(Pan-, pang-, ika-) + siyam
Six (6)	Unom, sais	Tenth	(Pang-, ika-) + napulo
Seven (7)	Pito, syete	Eleventh	(Pan-, pang-, ika-) + onse
Eight (8)	Walo, otso	Twelfth	(Pan-, pang-, ika-) + dose
Nine (9)	Siyam, nwebe	Thirteenth	(Pan-, pang-, ika-) + trese
Ten (10)	Napulo, dyes	Fourteenth	(Pan-, pang-, ika-) + katorse
Eleven (11)	Onse	Fifteenth	(Pan-, pang-, ika-) + kinse
Twelve (12)	Dose	Sixteenth	(Pan-, pang-, ika-) + desisais
Thirteen (13)	Trese	Seventeenth	(Pan-, pang-, ika-) + desisyete
Fourteen (14)	Katorse	Eighteenth	(Pan-, pang-, ika-) + desiotso
Twenty (20)	Baynte	Nineteenth	(Pan-, pang-, ika-) + desinwebe
Thirty (30)	Traynta	Twentieth	(Pan-, pang-, ika-) + baynte
One hundred (100)	Gatos, syen	Hundredth	(Pan-, pang-, ika-) + syen, (Pan-, pang-, ika-) + usad kagatos
One thousand (1,000)	Usad kalibo, libo, ribo, sangribo, mil	Thousandth	(Pan-, pang-, ika-) + usad kalibo
One million (1,000,000)	Usad kamilyon, milyon	Millionth	(Pan-, pang-, ika-) + usad kamilyon

C. Counting and ordering numbers

In counting and ordering numbers, remarkable features can be observed. There are Minásbate equivalents for numbers 0 through 10, hundred, and thousand. However, counting numbers greater than 10 are typically of Spanish origin. Alternately, Spanish counting numbers from 1 to 10 are also being used. One theory cited by Tirol (2010) for the lack of local equivalents for counting numbers beyond 10 is the replacement done by Spanish colonizers for them to pronounce the numbers with ease. Like the primitive Visayans and Bicolanos, Masbateño people might have known these numbers as *napulo kag usad, napulo kag duwa, napulo kag tulo,* and so on by adding tens and ones, which are lengthy and difficult to pronounce on the part of the aliens.

In ordering numbers, the natives use any of the prefixes *pan-, pang-, pam-,*and *ika-*. The first three prefixes are of Visayan origin, while the fourth is of Tagalog. Furthermore, the four prefixes are used interchangeably in all numbers, except *pan*-in the seventh order which is known as *pampito*, not *pan-pito*. However, Spanish ordering is also used in the first few numbers, such as *una/primero/primera*, *segunda*, and *tarsera.* These ordering orthographies are being used in various socio-cultural activities and situations alternately. For example, the Spanish ordering is used by vehicle drivers in gear shifting; the Minásbate ordering is used in church readings, birth order, etc.

In Table 3, code-switching in Minásbate counting and orthographic diversity in ordering can be noted. This phenomenon is a product of historical manipulation and not of natural acculturation, since it was greatly influenced by Spanish occupation. The absence of local equivalents for numbers greater than 10 does not imply the natives' lack of concepts with larger numbers. The presence of equivalent terms *gatos* for hundred and *ribo* for thousand indicates their innate ability to count up to six-digit numbers.

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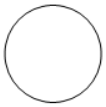
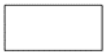
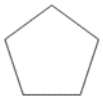
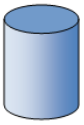
Table 4. Geometrical concepts' Minásbate equivalents and their regularity/shortage

Geometrical Figure/ Concept	Equivalent/ Description	Regularity	Shortage
	*Bilog* *Talimon* *Matipuron/Manipuron* *Serkulo*	55.2% 17.2% 6.9% 1.7%	8.6%
	*Triangulo* *Trayanggol* *Tres kantos*	41.4% 10.3% 8.6%	22.4%
	*Kwadrado* *Kwatro-kanto* *Iskwer*	46.6% 13.8% 10.3%	13.8%
	*Rektanggulo* *Pahalaba* *Rektanggel*	17.2% 12.1% 6.9%	37.9%
	*Pentagon* *Singko-kanto*	6.9% 3.4%	69.0%
	*Lata* *Baso* *Silindrika/Silindriko* *Silindro* *Silinyador*	24.1% 6.9% 5.2% 5.2% 5.2%	36.2%
	*Piramid* *Trayanggol*	20.7% 3.4%	62.1%
	*Kahon* *Gantangan* *Kubiko* *Karton* *Kwadrado*	24.1% 19.0% 5.2% 5.2% 5.2%	19.0%
	*Apa* *Imbodo* *Trumpo* *Kalo* *Turutot* *Balisungsong* *Basuso*	22.4% 6.9% 5.2% 5.2% 5.2% 1.7% 1.7%	34.5%
	*(Pa)bilog* *Bola* *Bulan* *Matalimon* *Dayametro*	27.6% 13.8% 13.8% 3.4% 3.4%	24.1%

D. Geometrical shapes and figures

During the face-to-face interviews, the respondents were shown some unnamed geometric figures, such as circle, square, triangle, rectangle, pentagon, cylinder, pyramid, cube, cone, and sphere. They were asked to tell the words they use to describe the figures. Their responses were categorized as either an exact equivalent or a descriptive concrete example of the concept. Furthermore, the frequency of the responses was used to calculate the percentage of respondents who had mentioned the same equivalent. Empty responses were also considered in the analysis. Table 4 shows the figures and the equivalents, their regularity and shortage.

In quantitative analysis of the responses on geometrical shapes and figures, this study used the computation of the equivalent's regularity and concept's shortage of equivalence. High regularity means that the term is being used by greater populace in the area. High degree of shortage, on the other hand, means that there is no common term being used or the concept is very unfamiliar.

Etymologically speaking, the equivalents of geometrical shapes are mostly borrowed from foreign languages. Some terms are of Spanish origin, such as *kwadrado, serkulo, silindro, tres kantos, kwatro-kanto, kubiko*, etc. Other terms were found to be English (e.g., *trayanggol*, *iskwer*, pentagon, *rektanggel*, and *piramid*).

Familiar shapes have Minásbate equivalents. These shapes include circle, sphere, cylinder, cone, and cube, all of which are abstract mathematical concepts with many concrete representations found in nature. Their equivalents consist of descriptions and concrete examples. For instance, circle is known by the equivalents *bilog, manipuron/matipuron,* and *talimon*; sphere is known as the same equivalents as in circle, and additional concrete examples *bola* (ball) and *bulan* (moon); cylinder is *lata* (can) and *baso* (drinking glass); cone is *apa* (ice cream cone), *imbodo* (funnel), *trumpo* (top), *kalo* (hat), *turutot* (horn), *balisungsong/basuso* (a cone-shaped food wrapped in banana leaves); and cube is *kahon* (box), *gantangan* (a wooden cubed box used to measure quantity of rice), *karton* (box). This shows that the respondents tend to exemplify rather than translate the abstract geometric concepts. Less naturally common concepts like pentagon and pyramid did not have Minásbate equivalents (since they have higher incidents of usage shortage) and were all known by their foreign terms only. Therefore, grounding on the equivalents present and their origins/types, it can be inferred that

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the ways of thinking of the aboriginals were probably less abstract, as there had been no unique terms used to represent abstract geometrical ideas.

CONCLUSIONS

The responses of the senior residents of Masbate were deemed to provide an unequivocal authority on the descriptions of some mathematical ideas in the local language. Based on the findings, it was implicated that the mathematical culture of Masbateño people were an assimilation of various ethno-linguistic groups. Historically, the nearly three centuries of Spanish conquest had tremendous influence on the evolution of the local language, and the geographical location of Masbate at the center of the diversely tongued Philippine archipelago made it possible for cross-cultural intercourse to enrich the lexical and orthographic systems of Minásbate vocabulary used in representing mathematical ideas. Finally, the lack of unique equivalents for abstract geometrical and spatial concepts indicates the predominant metaphorical ways of thinking among the primeval natives.

RECOMMENDATIONS

The anthology of Minásbate equivalents of some mathematical concepts in this study forms an authoritative glossary for educational use. This also sets the foundation for future investigations on the socio-culturalmeanings of local mathematical vocabulary. Furthermore, it is recommended that similar efforts be done to promote the appreciation, preservation, and in-depth understanding of Masbateño culture and language.

Few limitations were observed in this study. First, the lack of concrete geometric models during the interviews prevented the respondents from having the spatial grasp of the figures. This might have some effects on the respondents' perceptions of the concepts; that is, seeing solid models as plane figures. Second, the respondents were not systematically chosen in terms of their gender and locality. Lastly, the etymological analysis was done only by studying the orthography and lexical similarities between languages/dialects. Further studies on the same subject—using more appropriate sampling, instrument, and research design—are recommended to validate the results of this study.

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